CLAIMS:

1. A method of detecting trace quantities of a molecular target by exploiting a specific interaction between the target and two molecular probes, comprising:

attaching one of said molecular probes to a conductive bead,

fixing the other of said probes in a gap between two electrodes,

applying an electric potential to said electrodes, and

monitoring for an increase in electrical current from one of the electrodes to the other as might occur if said conductive bead is drawn into said gap by said specific interaction.

2. The method of Claim 1 wherein one of the probes is physically bound to a "well" between the electrodes.

3. The method of Claim 1 wherein the conductive bead is an iron bead.

4. The method of Claim 1 wherein the conductive bead is demagnetized prior to attachment of said one of the molecular probes.

5. The method of Claim 4 wherein said demagnetization is by heating in an environment shielded from the Earth's and other magnetic field(s).

6. The method of Claim 1 wherein the conductive bead is prevented from rusting by removing all oxygen from the carrier fluid.

7. The method of Claim 1 wherein the physical positioning of the iron beads between the electrodes causes a circuit to close.

8.The method of Claim 1 wherein specificity of the reaction between the probe and the target is the basis of detection.

9. The method of Claim 1 when adopted to detect multiple agents/molecules in a microprocessor-controlled micro-array.

10. The method of Claim 1 when adopted to assay the concentration of a given substance.

11. A method of detecting trace quantities of a molecular target by exploiting a specific interaction between the target and two molecular probes, comprising the steps of:

(a) preparing a specimen by putting a gas or solid into solution or otherwise preparing an agent to be identified,

(b) introducing the specimen into a detecting device including a gap between two electrodes, which contains bound probes, and allowing for binding/hybridization to occur,

(c) before, during or after step (b) adding a second probe that is bound to an electrically conductive bead and allowing for specific binding/hybridization to occur, and

(e) determining if binding of the conductive bead to the gap has occurred by detecting a change in any electrical current between the electrodes.

12. The method of Claim 11 wherein step (e) is preceded by:

(d) adjusting chemistry and/or temperature of the solution to optimize reaction conditions.

13. The method of Claim 11 wherein step (e) employs the use of a microprocessor.

14. The method of Claim 11 wherein step (a) includes physically and/or chemically reducing a cell to its components to liberate them for detection.

15. The method of Claim 1 engineered into two or three-dimensional micro-arrays and used to detect multiple different molecules of different chemical nature, including but not limited to nucleic acids, proteins, carbohydrates, lipids and inorganic molecules.

16. The method of Claim 15 including built-in duplications or triplications for quality control.

17. The method of Claim 15 including an electronic self-check and/or pre-analytic test run with negative controls.

18. The method of Claim 15 including a post-analytic test run with positive controls should the test result be negative.

19. A method for assaying the concentration of a given substance, comprising:

providing an array of individual chips, each providing a closed electrical circuit including bound analyte and conductive beads between a pair of electrodes, wherein the chips differ in the size of the gap between the electrodes and the quantity of bound analyte and hence quantity of said beads,

introducing a sample containing an unknown

quantity of analyte to the micro-array,

whereby the analyte displaces the bead-bound probes competitively in chips containing a given amount or less of bound analyte but not those containing a larger amount of bound analyte, and chips that have sufficient beads displaced will be converted to an open circuit.

20. The method of Claim 19 wherein prior calibration with standards of known concentrations permits the assay of the concentration of analyte in the sample.

21. A method for assaying the concentration of a given substance, comprising:

providing an array of identical chips, with a small gap between two electrodes that accept only one conducting bead each and with well-bound probes,

introducing a sample containing an unknown quantity of analyte to the micro-array within a cassette that contains known amounts of added bead-bound probes in lesser quantity than the analyte in the sample, whereby

a free analyte competes with analyte-bound bead-bound probes (formed after introduced analyte react with bead-bound probes inside the cassette) for binding with said well-bound probes on a limited number of said chips.

21. The method of Claim 21 comprising computation of a concentration of the analyte in the sample using prior knowledge of the amount of bead-bound probe, the proportion of "on" to "off" signals registered by the microprocessor and prior calibration with standards of known concentrations of analyte.

22. Apparatus for detecting trace quantities of a molecular target by exploiting a specific interaction between the target and two molecular probes, comprising:

a well having two electrodes spaced apart to form a gap and one of said probes attached to the well,

means for applying an electric potential to said electrodes, and

means for monitoring for an increase in electrical current from one of the electrodes to the other as might occur if a conductive bead having the other of said molecular probes attached thereto is drawn into said gap by said specific interaction.

23. The apparatus of Claim 22 in combination with a plurality of other identical apparatus in micro-arrays thereof.

24. The combination of Claim 22 wherein the micro-

arrays are housed within a cassette.

25. The combination of Claim 24 further in combination with a portable device constructed with a slot that accepts the cassette.

26. The combination of Claim 25 further including a microprocessor that reads the contents of the cassette from an identifier on the cassette.